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NEW TAXA AND NOMENCLATURAL PROPOSALS IN MISCELLANEOUS FAMILIES—UTAH AND ARIZONA

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ABSTRACT. Six new taxa from Utah and one from northern Arizona are described and one new nomenclatural proposal is presented, as follows: *Erigeron huberi* S. L. Welsh & N. D. Atwood, *sp. nov.*; *Salvia columbariae* var. *argillacea* S. L. Welsh & N. D. Atwood, *sp. nov.*; *Astragalus lentiginosus* Douglas *ex* Hook. var. *trumbullensis* S. L. Welsh & N. D. Atwood, *var. nov.*; *Sphaeralcea grossulariifolia* (Hook. & Arn.) Rydb. var. *fumariensis* S. L. Welsh & N. D. Atwood, *var. nov.*; *Oenothera murdockii* S. L. Welsh & N. D. Atwood, *sp. nov.*; *Aquilegia desolaticola* S. L. Welsh & N. D. Atwood, *sp. nov.*; *A. fosteri* (S. L. Welsh) S. L. Welsh, *comb. nov.*; *A. loriae* S. L. Welsh & N. D. Atwood, *sp. nov.*

Key Words: Compositae, Labiatae, Leguminosae, Malvaceae, Onagraceae, Ranunculaceae, nomenclature, Utah, Arizona

Continued exploration of the varied and numerous habitats of Utah and northern Arizona, and further examination of herbarium specimens from those places, demonstrate the existence of seven new taxa. These have been compared not only with specimens from elsewhere in Utah and Arizona, but also with those in much of the American West. These taxa represent local entities with narrow ranges of ecological tolerance, and they are often restricted to specific geological strata or narrowly defined habitats. Admittedly, much work remains to be done. The flora, after more than 15 decades of exploration, is still imperfectly known, and potentially there are other narrowly endemic taxa to be discovered, described, and named.

COMPOSITAE

Erigeron huberi S. L. Welsh & N. D. Atwood, *sp. nov.* TYPE: U.S.A. Utah: Duchesne Co., Lake Fork Mtn., Uinta Mtns., T2N R5W S16, NW1/4 of NE1/4, Uinta Base Meridian. Plants growing along windswept ridge crest above limestone talus slopes, rocky soils, 10,900 ft., 21 Jul 1998, *A. Huber & C. Wedig 3825* (HOLOTYPE: BRY!; 7 isotypes to be distributed).

Similis *Erigeron untermannii* S. L. Welsh & Goodrich in aspectis generalibus sed in caudicibus simplicibus involucro breviore et radiis angustioribus differt.

Perennial pulvinate herbs with a shortly branched caudex, the caudex branches with few persistent leaves or leaf bases; leaves mainly or all basal, 0.3–2.2 cm long, 0.8–2.5 mm wide, narrowly oblanceolate to spatulate, the surfaces glabrous or with ascending hairs, ciliate (especially at the base) with hairs less than 1 mm long; cauline leaves 1 or commonly lacking; scapes (or peduncles) 1.5–2.7 cm tall; head solitary; involucres 5–10 mm wide, 3–5 mm high, the bracts more or less imbricate, green, or the inner somewhat chartaceous, the margins hyaline, the tips greenish or stramineous, rather densely villous-hispidulous with short, spreading, multicellular hairs; rays 12–30, white, violet-tinged, or violet, 3.5–7 mm long, 0.7–1 mm wide; disk corollas 2–2.3 mm long; pappus apparently single, of ca. 10 slender, fragile bristles; achenes 2-nerved, pilose.

ADDITIONAL SPECIMENS (PARATYPES): UTAH: Duchesne Co., Lake Fork Mtn., Uinta Mtns., T2N R5W S16, NW1/4 of NE1/4, Uinta Base Meridian, limestone substrate, rocky and gravelly soils, windswept ridge top above limestone talus, scattered spruce trees, 10,900 ft., 2 Jul 1998, *Huber & Wedig 3752* (BRY!).

HABITAT AND DISTRIBUTION. *Erigeron huberi* grows on alpine ridge crests above limestone talus with scattered spruce krummholz at ca. 3325 m. It is known only from Lake Fork Mountain, Uinta Mountains, Duchesne County, Utah. The species is endemic (Figure 1).

This species seems almost certainly to be closely allied to the nearby disjunct species, *Erigeron untermannii* S. L. Welsh & Goodrich, with which it is compared in the diagnosis. That species occurs on the south rim of the Uinta Basin in Utah. In the key to the species in Cronquist's (1947) revision, the plants would key to the rare Canadian species, *E. radicatus* Hook., because of their short disk corollas and few pappus bristles. From that species, disjunct by several hundred kilometers, the present taxon differs in its less complex caudex, fewer cauline leaves (0 or 1, not 2 or 3), and fewer (12–30, not 20–50) and narrower (0.7–1,

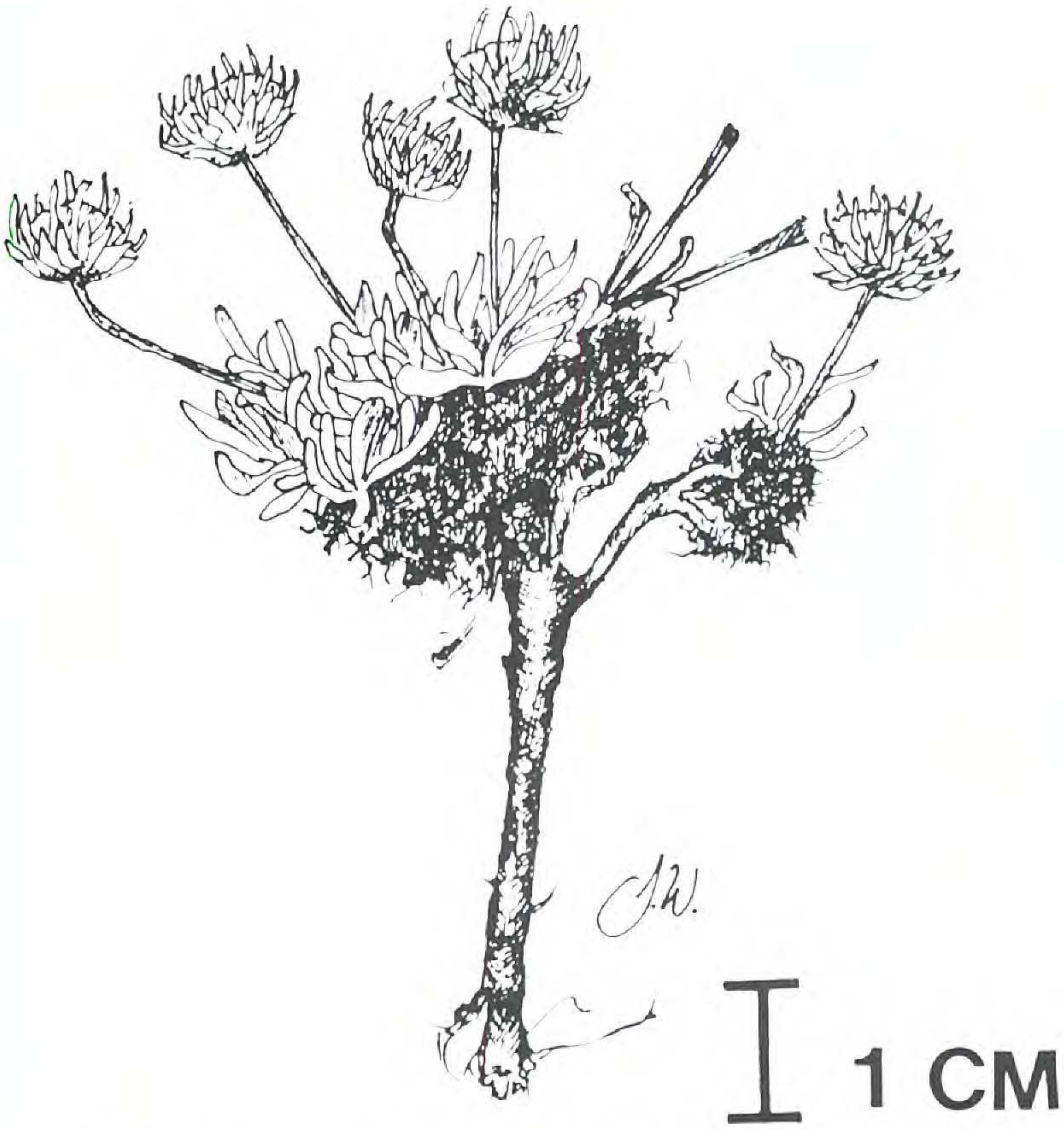

Figure 1. *Erigeron huberi* S. L. Welsh & N. D. Atwood (*Huber & Wedig 3825* BRY).

not 1.9–2.2 mm) ligules. From *E. nanus* Nuttall, a disjunct species from southern Wyoming, Idaho, and northwestern Utah, it differs in the less complex caudex, the shorter ciliate hairs at the leaf base (less than 1, not over 1 mm), shorter involucres (3–5, not 5–8 mm), and narrower ligules (0.7–1, not 1.3–2.5 mm wide).

A closely similar collection, identified tentatively as *Erigeron radicatus* by its collector (*Mosely 1526* BRY!), is known from Lemhi County, Idaho. It differs in subtle ways from both the present proposal and from *E. radicatus,* i.e., in having 22–33 ligules (these 1.1–1.3 mm wide), cauline leaves consistently 1 or 2, and basal leaves 0.8–1.3 mm wide. There are, in *Mosely 1526*, other subtle differences in pubescence, that of the stem being more densely and uniformly ascending-hairy, that of the involucres being spreading-pilose.

The species is named after Alan Huber, enthusiastic collector and student of the floras of the Uinta Mountains and Uinta Basin of Utah.

LABIATAE

Salvia columbariae Benth., Labiat. Gen. Spec., fasc. 3: 302. 1833.

Annual; stems branching and leafy at the base, 1–5 dm tall, cinereus with short retrorse hairs; basal leaves 3–18 cm long, the petioles 1.5–7 cm long, the blades 2–11 cm long, oblong-ovate, pinnatifid or bipinnatifid into toothed or incised divisions; flowers in capitate verticels, these 1–3 cm wide, terminating the stems and branches; bracts suborbicular, awn-tipped, suffused with rich dark purple or merely purple; calyx ca. 1 cm long, purplish, arcuate, the middle spinose tooth of the upper lip bifid or trifid, the lobes 1.5–2.6 mm long; corolla blue; stamens with upper arm of connective linear and lacking an anther, the lower branch deflexed and with a fertile anther.

The above description is for the typical variety. The differences between it and var. *argillacea* are given in the following key and in the description of var. *argillacea.*

1. Flowers blue; floral bracts typically a rich dark purple, the median calyx teeth with bifid or less commonly trifid awns 1.5–2.6 mm long; plants of alluvial substrates at low elevations in Washington Co., Utah and widely distributed elsewhere .... 1a. var. *columbariae*

1. Flowers white; floral bracts green or less commonly some suffused with red purple, the median calyx teeth mainly with bifid awns 0.8–1.5 (–1.7) mm long; plants of the clays of the Chinle Formation at higher elevations in eastern Washington and central to western Kane Cos., Utah .... 1b. var. *argillacea*

1a. var. *columbariae*

This variety grows in creosote bush, Joshua tree, blackbrush, and pinyon-juniper communities at 800 to 1465 m in western Washington Co., Utah, and in California, Nevada, Arizona, and Mexico. The plants flower in Utah from mid-March to mid-May.

1b. var. **argillacea** S. L. Welsh & N. D. Atwood, *var. nov.* TYPE: U.S.A. Utah: Kane Co., clay-silt of Chinle Formation, *Phacelia-Eriogonum-Astragalus* community, at 1700 m, Kitchen Corral Canyon, 1 mi. W of Kitchen Corral Point & 6 mi. SW of Mollies Nipple, T41S R3W S33, red-purple outcrops, sparsely vegetated in pinyon-juniper community, 5 Jun 1993, *S. L. Welsh 25642* (HOLOTYPE: BRY!; 9 isotypes distributed previously as *Salvia columbariae*).

Ab *Salvia columbariae* Bentham in floribus bracteis et calycibus coloris et dente calycis bifidis brevioribus absimilis.

Annual; stems branching and leafy at the base, 0.9–3.7 dm tall, cinereus with short retrorse hairs; basal leaves 3–7 cm long, the petioles 1.0–3.8 cm long, the blades 2.0–5.5 cm long, oblong-ovate, pinnatifid or bipinnatifid into toothed or incised divisions; flowers in capitate verticels 1–3 cm wide, terminating the stems and branches; bracts suborbicular, awn-tipped, green, or rarely suffused with red-purple; calyx ca. 1 cm long, green, arcuate, the middle spinose tooth of the upper lip bifid, the lobes 0.8–1.5 (–1.7) mm long, rarely shortly trifid; corolla white; stamens with upper arm of connective linear and lacking an anther, the lower branch deflexed and with a fertile anther.

ADDITIONAL SPECIMENS (PARATYPES; ALL BRY!): UTAH: Kane Co., location as for the holotype, 18 Jun 1998, *Atwood & Welsh 23896*; ditto, 4 Sep 1998, *Atwood & Welsh 24126*; Washington Co., along dirt road south of Rockville and at the west base of Smithsonian Butte, 26 May 1973, *Atwood 5141*; ditto, 6 mi. N of Hwy. 59 on the Big Plain junction road to Rockville, T42S R11W S21, Chinle Formation, 8 Jun 1976, *Atwood 6748*; ditto, T42S R11W S16, Wire Mesa just NW of Smithsonian Butte, 8 Jun 1983, *Higgins 13641*; ditto, 1 Jun 1985, *Higgins 15579*; ditto, T41S R10W S14, 6 Jun 1984, *Welsh, Higgins & Thorne 22912*; ditto, Smithsonian Butte vicinity, ca. 5 mi. SW of Rockville, T42S R11W S21, 23 May 1985, *Welsh 23483*; ditto, 14 May 1986, *Higgins 16415*; ditto, T42S R11W S14, 4 mi. SE of Rockville, 17 Jun 1987, *Thorne, Clark & Welsh 5387*; ditto, Petrified Forest, 2 mi. N of Rockville, T45S R11W S25, 11 Jun 1988, *Welsh 24045*; ditto, Parunuweap Canyon, Shunesburg, East Fork Virgin River, T42S R10W S3, 19 May 1989, *Higgins 18203*.

HABITAT AND DISTRIBUTION. *Salvia columbariae* var. *argillacea* is found growing with *Oenothera murdockii, Phacelia cephalotes, Eriogonum subreniforme, Molucella,* and *Astragalus ampullarius* communities on the Mesozoic Chinle Formation, in the pinyon-juniper zone at 1295 to 1700 m. It is endemic to eastern Washington County and western Kane County, Utah (Figure 2).

This white-flowered and typically green-bracteate taxon, with its shortly bifid calyx teeth, is apparently restricted ecologically to fine-textured, physiologically harsh, saline substrates of the Chinle Formation, where it grows with other peculiar plant taxa,

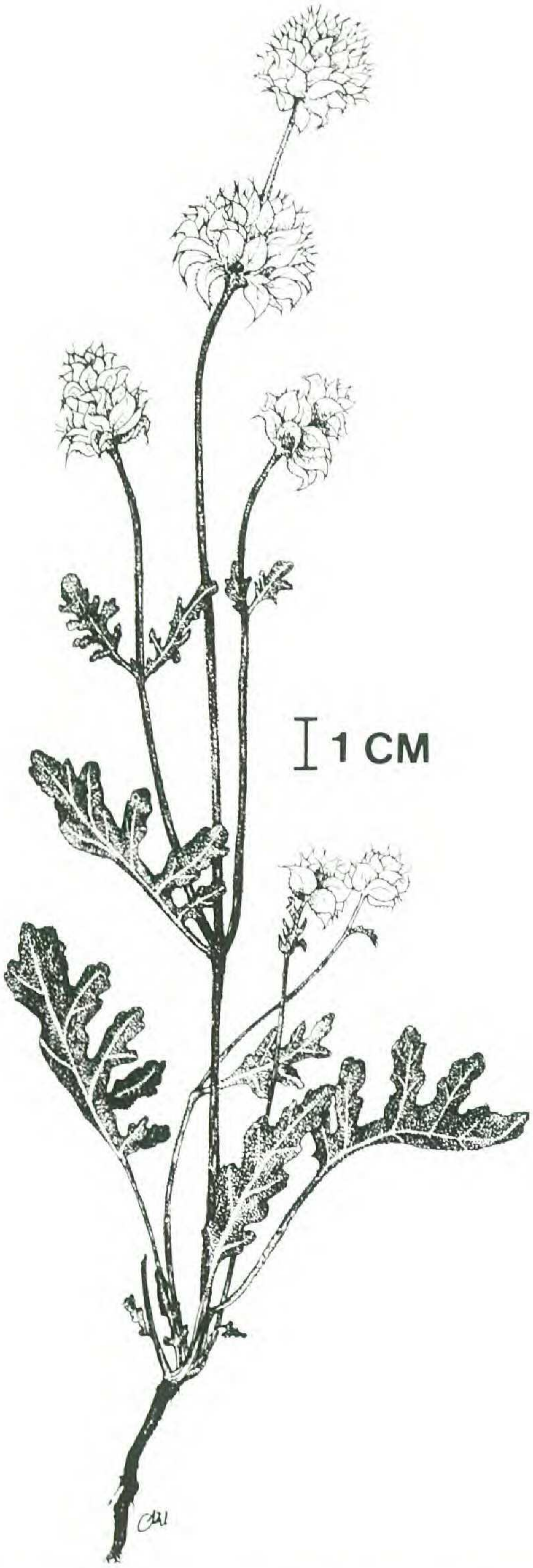

Figure 2. *Salvia columbariae* Bentham var. *argillacea* S. L. Welsh & N. D. Atwood (*Atwood & Welsh 23896* BRY).

often but not always, on bizarre "gypsum boils," which consist of upheaved portions of that formation. The typical, purple-bracteate and blue-flowered, *Salvia columbariae,* is a substrate generalist occurring mainly on alluvium or colluvium derived from many sources; it is not known from east of the Hurricane Cliffs in Washington County, Utah. There are specimens, which might belong to var. *argillacea,* known from the Chinle Formation in the vicinity of Quail Creek, on the southeastern flank of the Pine Valley Mountains, west of the Hurricane Cliffs. More materials of those are necessary to adequately assess their taxonomic status. There are, however, within the white-flowered populations occasional specimens whose bracts and/or calyces are tinged with red-purple. These individuals, as their white-flowered neighboring plants, have shortly bifid middle calyx teeth. The white-flowered plants have been collected from mid-May to mid-June.

LEGUMINOSAE

Astragalus lentiginosus Douglas *ex* Hook., Fl. Bor.-Amer. (Hooker) 1: 151. 1831.

Along the Grand Canyon in Northern Arizona and in adjacent southwestern Utah and southeastern Nevada, there exists a series of morphological subunits of the *lentiginosus* complex, most of which have been relatively unknown until rather recent times. Included are taxa that can be segregated, for the most part, into two groups by shape and inflation of the pods. One group, including vars. *oropedii* Barneby and *ambiguus* Barneby, has distinctly ovoid and inflated pods. Extralimital vars. *diphysus* (A. Gray) M. E. Jones, *vitreus* Barneby, and *wahweapensis* S. L. Welsh, likewise have ovoid, inflated pods. None of those are treated here. Rather this discussion centers on those entities with cylindrical or subcylindrical pods that are not greatly inflated, specifically, on var. *mokiacensis,* var. *palans,* and on var. *trumbullensis,* newly proposed herein.

Members of the group with cylindrical or subcylindrical pods have long been known, and have been summarized twice in the past several decades (Barneby 1945, 1964). Barneby's discussions and subsequent realignment of the included taxa are presented under the varieties treated below.

1. Pods substipitate to short-stipitate, the stipe 0.1–1 mm long;

leaflets pubescent on both sides (though sometimes sparsely so above); plants of the vicinity of Mt. Trumbull, Mohave Co., Arizona .... 2c. var. *trumbullensis*

1. Pods sessile; leaflets typically glabrous at least above; plants of various areas .... (2)
    2. Pods spreading to descending, mainly hamately or rather uniformly incurved, deciduous; wing petals typically purple apically; plants of sw. Colorado and n. Arizona along and n. of the Colorado River to se. and sw. Utah .... 2a. var. *palans*
    2. Pods erect-ascending, straight, steeply incurved-ascending, or rarely erect-ascending and decurved, persistent; wing petals typically pale or white apically; plants of the Beaver Dam Mts., and w. of Zion Canyon, Washington Co., Utah and adjacent Virgin Mts., nw. Mohave Co. Arizona and adjacent Clark Co., Nevada ....2b. var. *mokiacensis*

2a. var. *palans* (M. E. Jones) M. E. Jones, Contr. W. Bot. 8: 4. 1898. [*Astragalus palans* M. E. Jones, Zoë 4: 37. 1893. TYPE: "Montezuma Cañon, Utah, Jun 1, 1892, coll. by Miss Alice Eastwood" (HOLOTYPE: POM; ISOTYPES: CAS, GH, MO, NY, UC).]

Perennial (sometimes short-lived); leaves (3.5–) 5–11 cm long; leaflets 13–21 (–23), (3–) 5–17 (–23) mm long, broadly obovate-cuneate, oblong-elliptic, oblong-oblanceolate, or suborbicular-obcordate, obtuse, emarginate or subacute, flat or loosely folded; peduncles erect or incurved, shorter than or equalling the leaf; racemes loosely (6–) 10– to 28–flowered, the axis (1–) 2–12 (–14.5) cm long in fruit; calyx 6.3–9.4 mm long, either black- or white-strigulose, the tube 4.7–6.8 mm long, the teeth (0.9–) 1.1–3 (–4) mm long; flowers 13.5–17.5 (–18.3) mm long, pink-purple; pods spreading, declined, or spreading-ascending, obliquely linear-lanceolate to narrowly ovate-acuminate in outline, almost straight to uniformly or hamately incurved, (12–) 15–27 mm long, 4–8.5 mm thick, the unilocular beak 5–8 mm long, somewhat fleshy, green, glabrous or strigulose, becoming leathery or stiffly papery, stramineous (finally blackish), bilocular or nearly so; ovules 20–42.

HABITAT AND DISTRIBUTION. *Astragalus lentiginosus* var. *palans* flowers from April to June, and is found in salt desert shrub, blackbrush, juniper, pinyon-juniper, and mixed desert shrub communities at 1130 to 1900 m in southeastern and southwestern Utah, southwestern Colorado, and northern Arizona. How far var. *palans* extends along the Grand Canyon is subject to continued investigations, but all known records are from some distance to the east of the Mount Trumbull area.

Barneby (1964: 956) notes that, "var. *palans* consists of numerous races differing further in density and distribution of the pubescence, size of flowers, and length of fruiting raceme." He then cites specimens collected by Lemmon (*3116, 3326*), those with straight erect or ascending pods and leaves pubescent on both sides, as examples that might lead to further elaboration upon closer examination. He had treated them in his 1945 revision as part of var. *mokiacensis.* Those specimens have not been examined by us, but it seems more than likely that they represent what is considered below as var. *trumbullensis.*

2b. var. *mokiacensis* (A. Gray) M. E. Jones, Rev. N.-Amer. *Astragalus* 126. 1923. Mokiak milkvetch. [*Astragalus mokiacensis* A. Gray, Proc. Amer. Acad. Arts 13: 367. 1878. *Tium mokiacense* (A. Gray) Rydb. TYPE: "Mokiak Pass, on the borders of Utah and N. W. Arizona, Dr. Palmer, 1877" (HOLOTYPE: GH; ISOTYPES: K, NY 2 sheets, POM fragm., US. *A. ursinus* A. Gray, Proc. Amer. Acad. Arts 13: 367. 1878. *A. lentiginosus* var. *ursinus* (A. Gray) Barneby, Leafl. W. Bot. 4: 133. 1945.]

Perennial, mostly 20–60 cm tall; leaves 3–10 (–13) cm long; leaflets (7–) 9–17 (–21), 5–13 (–19) mm long, broadly obovate-obcordate, lanceolate, elliptic, or suborbicular-obcordate, emarginate or retuse to truncate, flat, pubescent to glabrous above; peduncles erect or incurved, 4–11 (–14) cm long, shorter than the leaf; racemes loosely 12- to 20-flowered, the flowers ascending, the axis 3.5–15 (–20) cm long in fruit; calyx 5–8 (–9.2) mm long, either black-strigulose or mixed black- and white-strigulose, the tube (3.5–) 4–6.5 mm long, short-cylindric to campanulate, the teeth (0.9–) 1–2 (–2.7) mm long, subulate; flowers (10–) 14–18 (–19) mm long, pink-purple or pink- to red-purple with pale or white wing-tips, the banner recurved through ca. 50°; pods ascending-erect to ascending or rarely spreading, sessile, oblong-ellipsoid, almost straight to incurved or decurved, 14–28 (–32) mm long, 4.5–6.5 (–8) mm thick, the unilocular beak 3–4 mm long, somewhat fleshy, green, glabrous or minutely pubescent, becoming leathery or stiffly papery, stramineous, bilocular or nearly so; ovules (22–24) 25–36; n = 11 (as var. *palans*).

HABITAT AND DISTRIBUTION. *Astragalus lentiginosus* var. *mokiacensis* flowers from March to June. It grows on limestone or outcrops and gravel or granitic gravels with *Hymenoclea,* bursage, Joshua tree, *Larrea,* and *Ferocactus* at 910 to 1750 m, in the Beaver Dam Mountains, Washington County, Utah, northwestern Mohave County (Grand Wash and vicinity), Arizona, and eastern Clark County, Nevada.

Placement of *Astragalus ursinus* within var. *mokiacensis* is justified on several bases. First, the reputed type locality in Utah has been ruled out by diligent search. Second, the collection by Palmer was labeled by C. C. Parry, subsequent to the arrival of specimens sent to him by Palmer at Davenport, Iowa, and it is almost certainly mislabeled. Probably it was collected by Palmer in northern Arizona at the same time as he collected the type of *A. mokiacensis.* The type, and only extant material of *A. ursinus,* closely resembles a slightly smaller flowered phase of var. *mokiacensis,* although plants with calyces matching the small size of those of the type of *A. ursinus* are still unknown within var. *mokiacensis.* Certainly, M. E. Jones, premier pioneer student of the complex in the American West, recognized the similarity by placing them within the same taxon as *A. ursinus.* He likewise discounted the presence of the taxon in Utah when he noted (Contr. W. Bot. 15: 21. 1929) that "*A. ursinus* . . . actually grows only in Arizona bordering the Grand Canyon."

The summary treatment of the *lentiginosus* complex by Barneby (1945) included *Astragalus mokiacensis* at varietal rank. He had seen only three collections at that time that exactly matched the type, but concluded that, "The variety in its strict sense is very closely related to var. *palans,* var. *Wilsonii,* and var. *ursinus,* and all four should perhaps be united." The var. *wilsonii* (Greene) Barneby is known from south of the Grand Canyon, and is excluded from treatment herein. Later, Barneby (1964: 580) removed *A. mokiacensis* from consideration within the *lentiginosus* complex, placing it instead within sect. *Preussiani.* He justified that decision on the basis of similarity of flowering specimens and juxtaposition of *A. preussii* A. Gray with the distribution of

Astragalus mokiacensis. However, all members of sect. *Preussiani* are evidently obligate selenophytes, with strictly unilocular pods. *A. mokiacensis* is, instead, an obligate or essentially obligate calciphile, occurring always or almost so on limestone substrates, typically on cliffs and rock outcrops; and it has bilocular or nearly bilocular pods.

With the rather large number of specimens of var. *mokiacensis* now available for study, we can find no consistent floral differences, aside from the pale or white wing tips, between this taxon and var. *palans,* with which it has been consistently confused in Washington Co., Utah. Even pod features do not differ in any consistent manner. However, the pods of var. *palans* tend to spread, and have erect-ascending tips, while those of var. *mokiacensis* are typically stiffly erect-ascending.

2c. var. **trumbullensis** S. L. Welsh & N. D. Atwood, *var. nov.* TYPE: U.S.A. Arizona: Mohave Co., Mohave Strip, Andrus Canyon, 3 mi. W of Andrus Pt., T32N R10W S6, wash bottom with *Mortonia, Purshia, Ephedra, Agave,* etc., 26 Apr 1999, *N. D. Atwood & B. Furniss 24293* (HOLOTYPE: BRY; six isotypes to be distributed).

Plantis similis vars. *mokiacensi* et *palanti* sed in leguminibus subsessilibus vel stipitatis e uterque in foliolis pubescentibus utrinque differt.

Perennial, mainly 30–35 cm tall; leaves 2–9.5 (–10.5) cm long; leaflets (7–) 13–17, 5–15 mm long, 2.5–8 mm broad, broadly obovate to oblanceolate or elliptic, retuse to rounded or subacute, flat, strigulose on both sides; peduncles erect or erect-ascending, 4.5–7.5 cm long, shorter than to somewhat surpassing the leaf; racemes loosely 4–15 (–17) -flowered, the flowers ascending, the axis 3–6.5 (–7.5) cm long in fruit; calyx 6.3–7.4 mm long, the tube 4.8–5.5 mm long, deeply campanulate, the teeth 1.7–2 mm long, triangular-subulate; flowers 13–17 mm long, pink-purple or pink- to red-purple with pale or white wing-tips, the banner recurved through ca. 40°; pods ascending-erect to ascending, subsessile to short stipitate, the stipe (gynophore) 0.1–1 mm long, the body linear-oblong to oblong or narrowly elliptic in profile, 17–32 mm long, 4–5.5 (–8.5) mm thick, subterete, the unilocular beak 3–5 mm long, somewhat fleshy, stramineous or mottled, strigulose, becoming leathery or stiffly papery, bilocular or nearly so; ovules 14–32.

ADDITIONAL SPECIMENS (PARATYPES; all BRY!): ARIZONA: Mohave Co., Parashant (Trail) Canyon, 11 mi. S of Mt. Trumbull Village, 26 Apr 1974, *Atwood 6029, 6029a*; ditto, Whitmore Canyon, 1.25 km (7.8 mi.) S of Mount Trumbull (abandoned town), T34N R9W S29, 25 May 1979, *Holmgren & Barneby 9172*; Daneill Canyon W of Andrus Canyon, 3 mi. W of Andrus Pt., T32N R11W S12, 26 Apr 1999, *Atwood & Furniss 24300*; ditto, Andrus Canyon, 1 mi. W of Andrus Pt., T32N R10W S10, 26 Apr 1999, *Atwood & Furniss 24302*; ditto, Whitmore Canyon, T32N R9W S1, 27 May 1999, *Higgins 20226*; ditto, 2 mi. S of Mt. Trumbull school house, near Griffith Knoll, T34S R10W S1–2, 27 May 1999, *Higgins 20277.*

HABITAT AND DISTRIBUTION. *Astragalus lentiginosus* var. *trumbullensis* flowers in April. This variety is found on sandstone outcrops and gravel, with *Mortonia, Purshia, Ephedra, Agave,* and other warm-desert shrubs at 910 to 1750 m, in canyons subsequent to the Colorado River, Grand Canyon, Arizona (Figure 3).

The material on which the above description is based has racemes loose as in both vars. *palans* and *mokiacensis,* but the raceme axis is shorter than that of the latter entity, i.e., 3–6.5 (–7.5) cm versus 5–15 (–20) in *mokiacensis,* and both of the varieties have sessile pods. However, leaflets of var. *trumbullensis* are pubescent on both sides (though sometimes thinly so above), unlike those of both vars. *palans* and *mokiacensis,* which are typically glabrous on one or both sides. Specimens have long been known, and the early collections cited above misled these workers into initial placement of them with var. *mokiacensis.*

MALVACEAE

Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. var. **fumariensis** S. L. Welsh & N. D. Atwood, *var. nov.* TYPE: U.S.A. Utah: Kane Co., west side, Little Valley, N of Lake Powell, T41S R6E S19, 6 May 1998, *S. L. Welsh & N. D. Atwood 26968* (HOLOTYPE: BRY!; five isotypes distributed previously as *Sphaeralcea grossulariifolia.*

Similis var. *grossulariifolia* in aspectem et amplitudinem sed pilis grose hirsuti-stellatis et carpelis obscure fenestratis differt.

ADDITIONAL SPECIMENS (PARATYPES; all BRY!): UTAH: Kane Co., head of

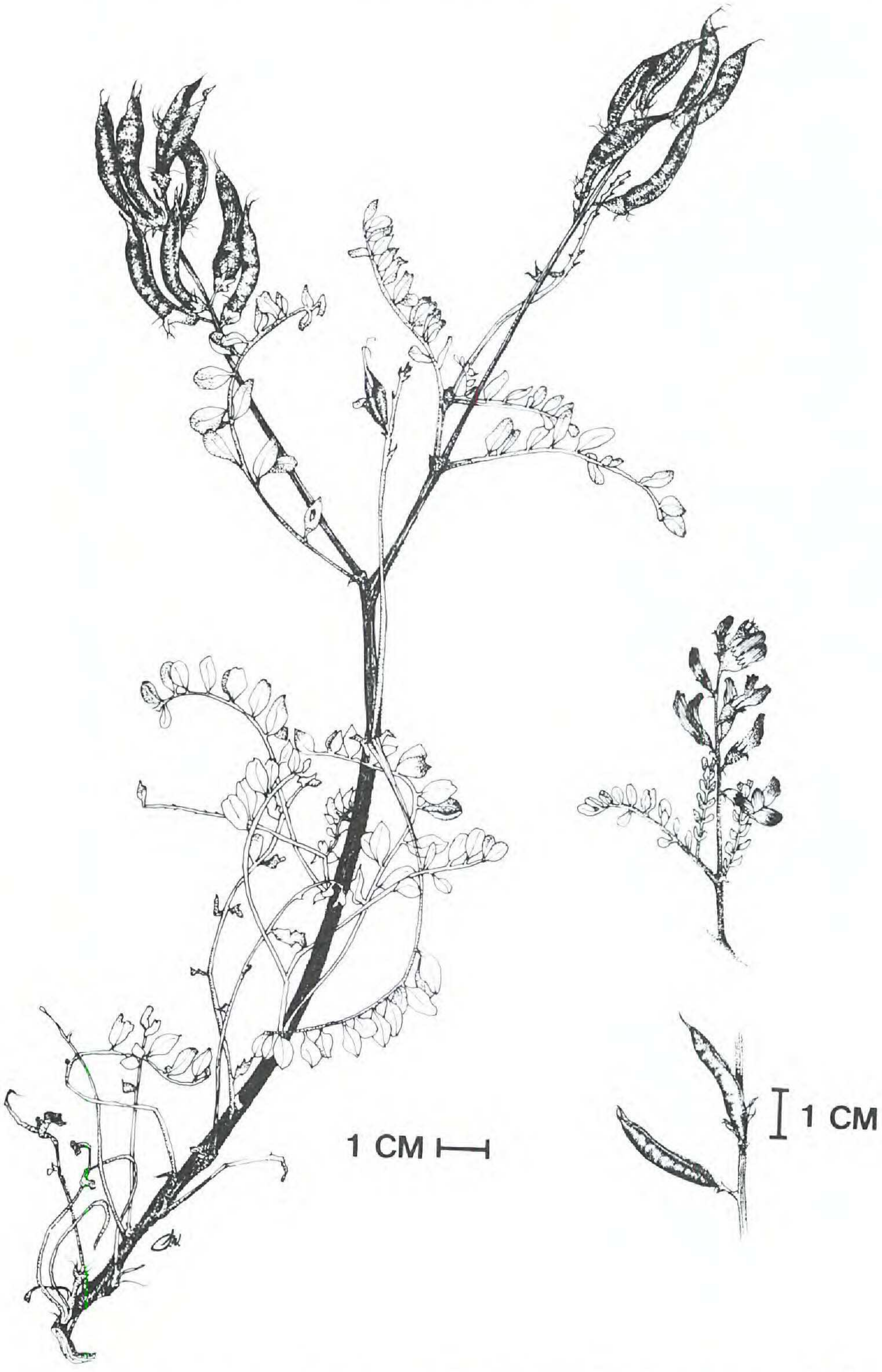

Figure 3. *Astragalus lentiginosus* Douglas *ex* Hooker var. *trumbullensis* S. L. Welsh & N. D. Atwood (composite of *Atwood & Furniss 23293* and *24300* BRY).

Smoky Hollow dugway, T41S R4E S8, 17 Jun 1998, *Atwood & Welsh 23859*; Tibbett Spring, T41S R3E S32, 20 May 1999, *Atwood et al. 24598*; ca. 7 mi. W of Smoky Mt., head of Creeks Rd., T40S R3E S36, 20 May 1999, *Atwood et al. 24614*; ca. 7 mi. W of Kelly Grade, Croton Junction, T43S R3E S14, 20 May 1999, *Atwood et al. 24627*; Drip Tank Canyon, E of Four Mile Bench, T40S R3E S24, 6 May 1998, *Welsh & Atwood 26938*; Reeses Canyon, ca. 2 mi. N of confluence of Last Chance Canyon/Reeses Canyon, T40S R4E S36, 21 May 1999, *Atwood et al. 24638.*

HABITAT AND DISTRIBUTION. *Sphaeralcea grossulariifolia* var. *fumariensis* is found with shadscale and creosote bush, and in other mixed desert shrub communities at 1220 to 1985 m in the vicinity of Smoky Mountain, eastern Kane County, Utah. It is endemic (Figure 4).

This phase of the widely distributed *Sphaeralcea grossulariifolia* has been known since it was first observed in the 1970s, during baseline studies of the then proposed Navajo and Kaiparowits electrical generating stations. No specimens were collected at that time, but the memory of them persisted through the decades until another opportunity at understanding the flora was triggered by the establishment of the Grand Staircase-Escalante National Monument.

In general aspect, var. *fumariensis* (name derived from Smoky Mountain and the Burning Hills portions of the Kaiparowits Plateau) closely simulates plants of var. *grossulariifolia,* whose distribution is contiguous, but evidently not within its range. Plants of var. *fumariensis* are geographically correlated with the Straight Cliffs Formation, and especially with that portion modified by natural fires that burned the coal in situ, resulting in thermally modified, red, brown, or yellow strata that tumble downward into the canyons as variegated, steep talus slopes.

The plants are at once notable because of their gray-hoary appearance, which results from the harsh, coarse, hirsute-stellate pubescence. That appearance differs markedly from both the green, thin-leaved var. *moorei* S. L. Welsh, which occurs along Glen Canyon to the east, and from var. *grossulariifolia* which is widespread elsewhere in Utah and the West.

Additionally, the carpel faces are only obscurely, if at all, fenestrate. The character of fenestrate faces is variable within the species as a whole, but the fenestrae are generally present elsewhere in the species.

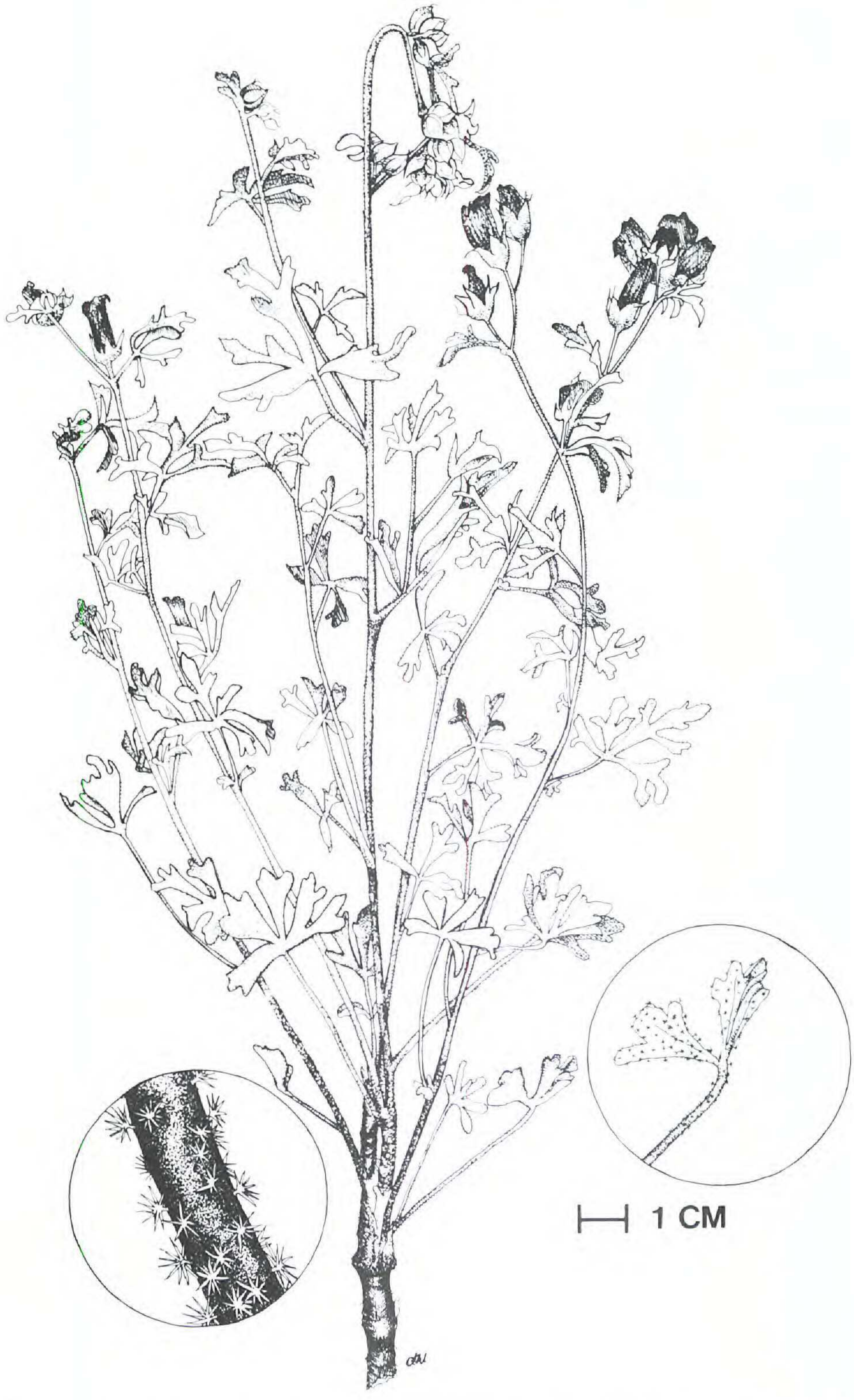

Figure 4. *Sphaeralcea grossulariifolia* (Hooker & Arnot) Rydberg var. *fumariensis* S. L. Welsh & N. D. Atwood (*Atwood & Welsh 23859* BRY).

The following key will serve to segregate the varieties of the species.

1. Herbage bright green; leaves thin-textured, often narrowly lobed; plants of the vicinity of Glen Canyon, eastern Kane and Garfield, and w. San Juan, Cos., Utah . . var. *moorei*
1. Herbage gray green or ashy green to whitish canescent or hirsute-stellate; leaves thick-textured, variously but often broadly lobed; plants with distribution as noted below 2
    2. Pubescence appressed or subappressed and finely stellate, the longest trichome hairs 0.15–0.3 (–0.4) mm long; plants widespread in the American West . . . . var. *grossulariifolia*
    2. Pubescence coarsely hirsute-stellate, the longest trichome rays up to 0.5–0.7 (–1.1) mm long; plants of Smoky Mt. and Burning Hills vicinity, e. Kane Co., Utah . . . . var. *fumariensis*

ONAGRACEAE

Oenothera murdockii S. L. Welsh & N. D. Atwood, *sp. nov.* Chinle evening-primrose. TYPE: U.S.A. Utah: Kane Co., clay-silt of Chinle Formation, *Phacelia-Eriogonum-Astragalus* community, at 1700 m, Kitchen Corral Canyon, ca. 1 mi. W of Kitchen Corral Point and 6 mi. SW of Mollies Nipple, T41S R3W S33, red-purple outcrops, sparsely vegetated in pinyon-juniper community, 5 Jun 1993, *S. L. Welsh 25643* (HOLOTYPE: BRY!; 3 isotypes distributed previously as *O. flava.*

Ab *Oenothera flava* (A. Nelson) Garrett in duratione annuis vel heime annuis radic-surculis axe petalis brevioribus (9–12 nec plerumque 15+ mm) absimilis, et a *O. primiveris* A. Gray in foliis puberulentis nec longipilis sepalis et petalis majoribus et capsulis non-alatis differt.

Annual acaulescent herb, with a heavily lignified taproot and simple shoot-crown, this long-persistent following death; leaves basal, 4–17.5 cm long, 0.5–3.5 cm wide, subentire or more commonly toothed or pinnatifid, the terminal lobe 1.5–5.5 cm long, 0.7–2.1 cm wide, puberulent to subglabrous; flowers clustered, solitary in leaf axils; hypanthium 2.5–4.5+ cm long; sepals 0.8–1.3 cm long, reflexed as a unit or two by two and with red margins or red overall; petals 9–12 mm long, yellow, drying yellow or orange-brown; capsules 1.3–2.5 cm long, evidently winged above the middle, the wings 3–7 mm wide; seeds in 2 rows per locule, 2.2–2.7 mm long.

ADDITIONAL SPECIMENS (PARATYPES; all BRY!): UTAH: Kane Co., Paria River, Paria, 1 May 1957, *Murdock 117*; ditto, 17 mi. E of Kanab, T43S R41/2W S34, 9 May 1987, *Franklin 4650A*; ditto, as for the holotype, 18 May 1994, *Welsh 25306*; ditto, 5 May 1998, *Welsh & Atwood 26921*; ditto, 17 May 1999, *Atwood, Welsh & Spencer 24473, 24478*; east of mouth of Fin Little Canyon, T42S R3W S8, *Atwood & Welsh 23901*; Washington Co., T42S R11W S14, 4 mi. SE of Rockville on rd. to Smithsonian Butte at junction of Wire Mesa Rd., 17 Jun 1987, *Thorne, Clark & Welsh 5385.*

HABITAT AND DISTRIBUTION. *Oenothera murdockii* occurs on Chinle and Moenkopi (?) formations barrens, with *Phacelia demissa, Eriogonum subreniforme,* and *Astragalus ampullarius* in the pinyon-juniper community at 1350 to 1750 m in Kane and Washington Counties, Utah. The species is endemic (Figure 5).

The Chinle evening-primrose has long been mistaken for the similar *Oenothera flava,* with which it is compared in the diagnosis. That plant occurs mainly at middle to upper elevations, often in mesic habitats. It is clearly perennial, the root-shoot axis not or hardly lignified, and the flowers are larger in all parts, even if the smaller ones overlap with those of the present proposal.

The plant, a survivor of harsh edaphic conditions, is named in memory of the late Joseph Richard (Dick) Murdock, who collected the earliest specimens of the species at BRY, and whose ecological specialty involved soil-plant relationships.

RANUNCULACEAE

The genus *Aquilegia* consists of a series of taxa that differ in rather inconsequential manners, especially as regards their basic structure (Munz 1946). That is, the leaves are practically always biternate or triternate, with taxa in which the former is generally the case having, on occasion, triternate leaves. The same is true for other vegetative features, and often for the floral ones as well. Proportion of flowers, including length-width comparisons, exsertion of stamens beyond the petal blades, length of petal spur to total flower length-width ratios, and length of sepals to spur length ratios seem to be of fundamental importance, however.

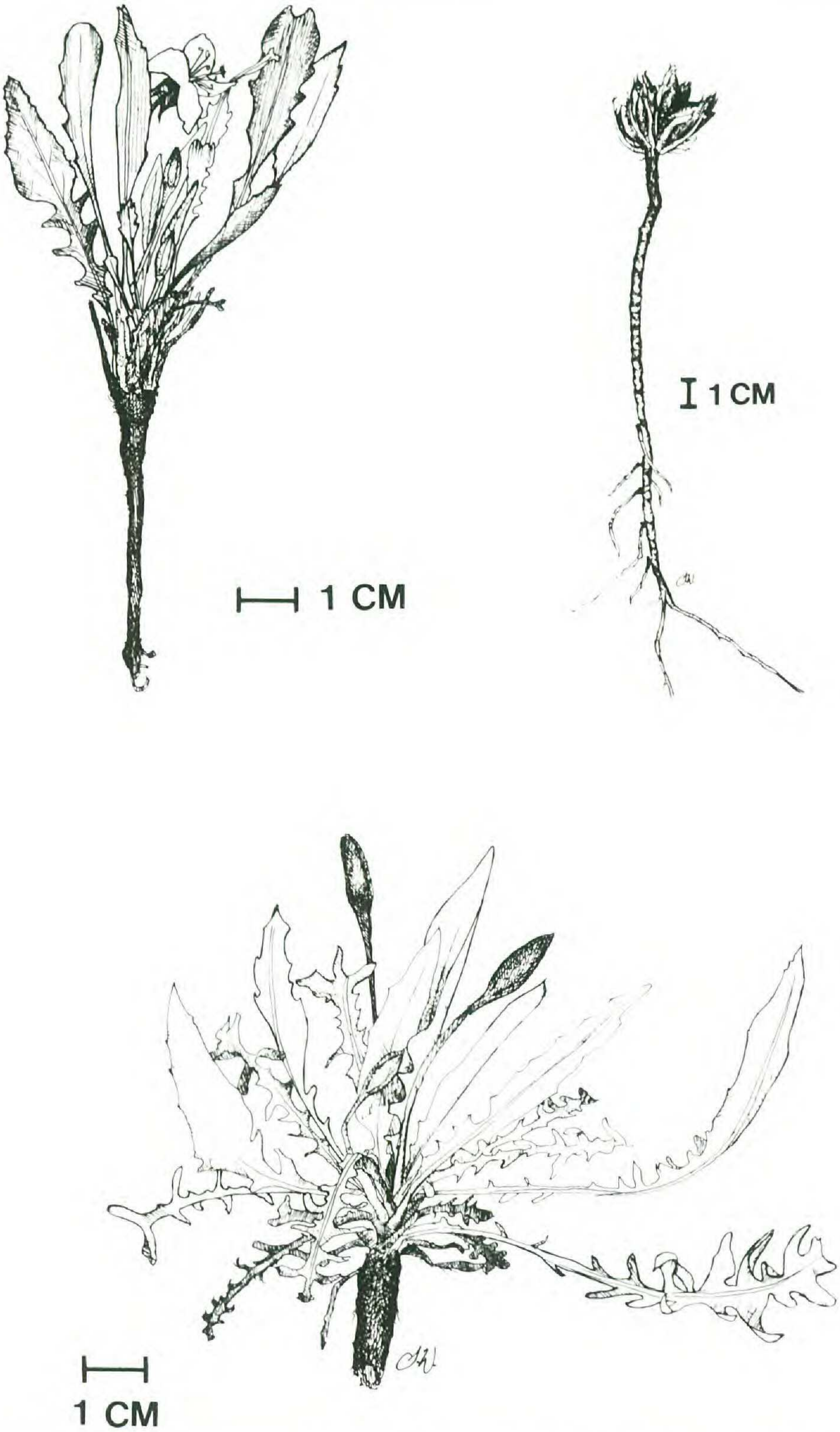

Figure 5. *Oenothera murdockii* S. L. Welsh & N. D. Atwood. Top left: Flowering plant (*Atwood, Welsh & Spencer 24479* BRY). Top right: Dead plant with capsules from previous year (*Welsh & Atwood 26921*). Bottom: Plant in bud (*Welsh & Atwood 26921* BRY).

Flower color is helpful to an extent, but in some taxa there is so much variation in flower hue as to negate its usefulness as a diagnostic tool. Payson (1918) discussed the problem of lack of diagnostic criteria in the genus. The species, despite the failure of any single morphological criterion as diagnostic, are rather readily identifiable in the field, and most often in the herbarium. Minute differences in measurements of any of the parts might not aid in identification, or in definition of the taxa, but the taxa tend to be isolated either geographically or ecologically from one another, and are therefore readily identifiable.

The two novelties described below do not fit well within any of the species of columbine known for Utah, and are therefore presented as new.

Aquilegia desolaticola S. L. Welsh & N. D. Atwood, *sp. nov.* TYPE: U.S.A. Utah: Grand Co., Desolation Canyon, Green River, Rattlesnake tributary, T18S R17E S32, 10 May 1999, *N. D. Atwood & A. Evenden 24464* (HOLOTYPE: BRY!; isotypes (4) to be distributed).

Similis *Aquilegia chrysantha* A. Gray in floribus coloratis sed in magnitudine et folis biternatis et foliis segmentis incrassatis differt, et ab *A. barnebyi* Munz in floribus aureus nec aurantiacis vel miniatis et in foliis amplitudine et segmentis incrassatis absimilis.

Plants mainly 4–6 dm tall; stems glabrous throughout or puberulent only above, forming large clumps, the caudex bases with conspicuous thatch of marcescent leaf bases; basal leaves (7–) 15–35 cm long, biternate, glabrous on both sides, the ultimate segments 1.8–5 cm long, 3.2–5.8 cm wide, the petioles 10–30 cm long, the petiolules 4–7 cm long; cauline leaves mainly 2 or 3 developed, the uppermost bracteate; pedicels mostly 3–7 cm long; flowers 1 to several, nodding, longer than broad; sepals horizontally spreading, 13–16 (–18) mm long, clear golden yellow or slightly suffused with or fading bluish or pinkish or fading yellowish throughout, elliptic to lance-elliptic; petals with spurs yellow, the blades golden yellow, 7–10 mm long; spurs 2.5–3.5 cm long; stamens exceeding blades by 7–12 mm; follicles 5–7, 1.7–2.5 cm long, puberulent.

ADDITIONAL SPECIMENS (PARATYPES): UTAH: Grand Co., T19S R16E S1, ca.

13 mi. due NNE of Green River, re-entry off Gray Canyon, at 4320 ft. elev., 28 May 1988, *Franklin 6124*; ditto, Desolation Canyon, Green River, below Coal Creek, Gray Canyon, T18S R17E S29, 10 May 1999, *Atwood & Evenden 24462*; Uintah Co., Desolation Canyon, Green River, across from Nutters Rock, T13S R17E S26, 10 Sep 1999, *Johnson 99–127, 99–141.*

HABITAT AND DISTRIBUTION. *Aquilegia desolaticola* inhabits seeps and adjacent moist sandy soil in the Tertiary Price River Formation along the Green River in canyons tributary to Desolation Canyon, at elevations of 1300 to 1350 m. to Grand and Uintah Counties, Utah. The species is endemic (Figure 6).

The flower color is much like that of *Aquilegia chrysantha,* but the taxon is probably most nearly allied to *A. barnebyi,* from which it differs in flower color, the longer and larger, biternate leaves, longer sepals, thicker leaf segments, and general habit. The caudex is conspicuously clothed with thickened marcescent leaf bases, which persist for many years in clumps. In this feature, the plants are unlike those of any other species in the state of Utah, with the exception of occasional specimens of long-persistant *A. micrantha.*

Aquilegia fosteri (S. L. Welsh) S. L. Welsh, *comb. nov.,* based on *A. formosa* var. *fosteri* S. L. Welsh, Great Basin Naturalist 46: 259. 1986.

Plants of this distinctive taxon have red and yellow or pink and yellow flowers and an overall glandular condition. Its more typical habitat is in perched crevice sites high along the Navajo and Kayenta sandstone walls of Zion Canyon. The seeds cascade downward from these high perches into the canyon proper where they germinate in moist sites, often clinging to vertical walls. Here the survivors hybridize with the golden-flowered, canyon bottom *Aquilegia chrysantha.* The resulting hybrids lack the distinctive glandular foliage, and have somewhat larger flowers intermediate in size between *A. fosteri* and *A. chrysantha,* often with very broad and pale spurs. The flowers of the hybrids and back-crosses do not retain the glandular condition and have flowers simulating the color, but not the proportions, of *A. formosa,* within which this taxon was previously named.

This entity has been annotated recently by A. T. Whitmore as belonging, in some part, to the look-alike, *Aquilegia desertorum* (M. E. Jones) Cockerell, a taxon that is not glandular-pubescent

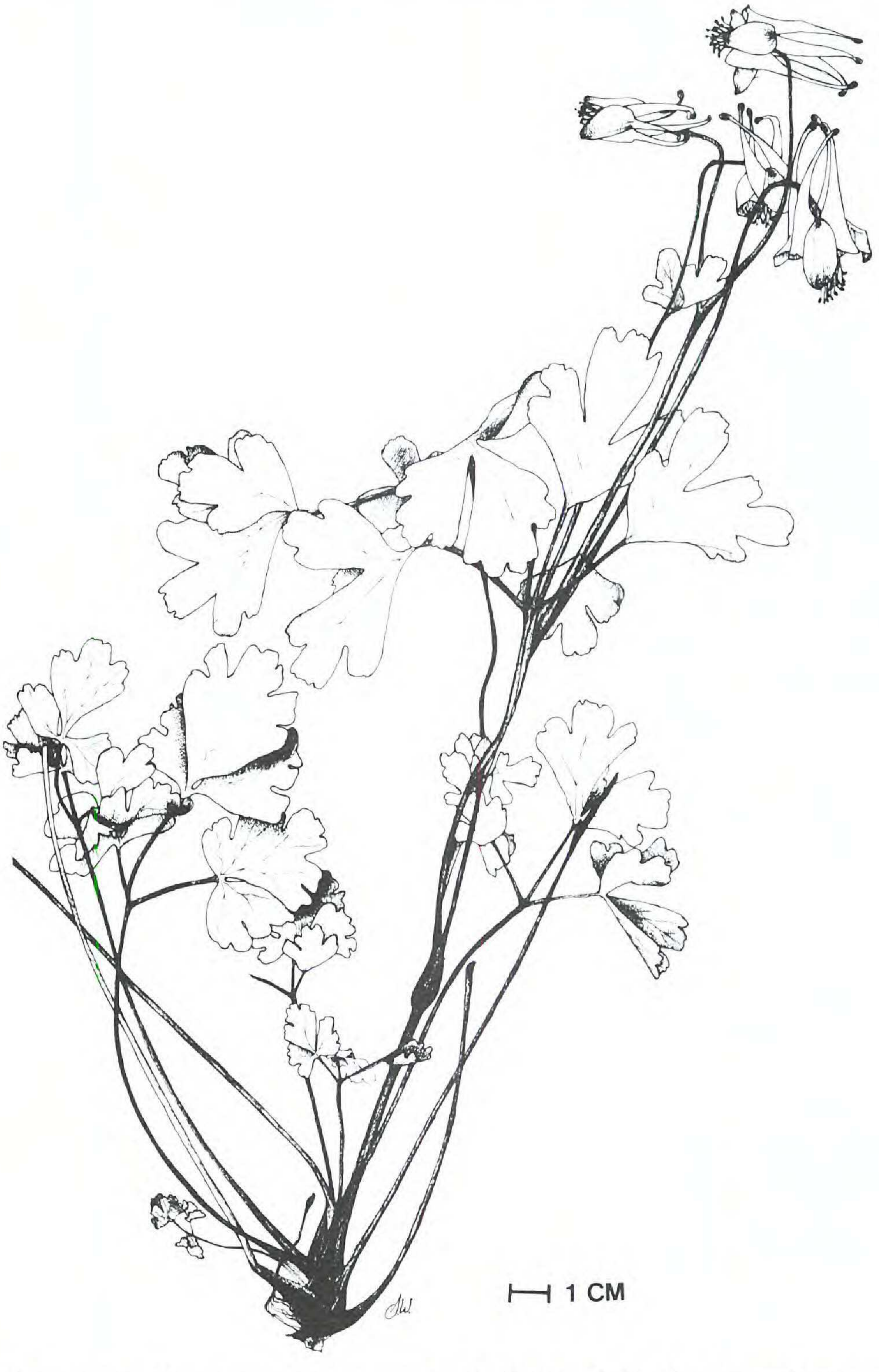

Figure 6. *Aquilegia desolaticola* S. L. Welsh & N. D. Atwood (*Atwood & Evenden 24464* BRY).

overall and which occurs at moderate elevations in northern Navajo and Coconino Counties, Arizona. Evidently that entity, in addition to lacking glandular pubescence in its lower parts, has shorter sepals (8–10 mm) and shorter spurs (15–22 mm). The occasional glabrous specimen from Zion Canyon appears to represent a back-cross between *A. fosteri* and *A. chrysantha,* or possibly it is nothing more than a part of the normal range of variation of the taxon.

Aquilegia loriae S. L. Welsh & N. D. Atwood, *sp. nov.* TYPE: U.S.A. Utah: Kane Co., Deer Spring Canyon, T41S R3W S7, ca. 5 mi. due W of Mollies Nipple, 37°15′0.3″N, 112°09′522.6″W, seep line ca. 450 ft. long, ca. 8 ft. high, with *Carex aurea,* Moenave Sandstone, hanging garden, at ca. 5840 ft., 14 Aug 1995, *S. L. Welsh, N. D. Atwood & L. Armstrong 26178* (HOLOTYPE: BRY!; several isotypes to be distributed).

Similis *Aquilegia fosteri* (S. L. Welsh) S. L. Welsh in habitu et foliis glandular-pubescentibus sed in sepalis et calcaribus longioribus absimilis, et *A. micrantha* Eastw. similis sed in floribus coloratis roseis vel salmoneis nec albidis et staminibus laminis minus longioribus differt, et ab *A. desertorum* (M. E. Jones) Cockerell in foliis glandular-pubescentibus nec glabris et petalis laminorum longioribus differt.

Perennial herbs, mainly 2.8–6.5 (–7.5) dm tall, 1–3.2 mm thick, simple to several-branched, glandular pubescent below and above or only above; basal leaves 0.8–3.5 dm long, biternate to triternate, with rather thin, green segments, and glandular-puberulent on both surfaces, or thickened and glabrous; petioles 8–22.5 mm long; primary petiolules 1–4.7 cm long, the secondary ones 0–1.5 (–2) cm long; leaflets cuneate-obovate to orbicular or broader, 0.5–3.5 cm long, cleft ca. 1/3 to 1/2 their length, the divisions again cleft or with rounded lobes; cauline leaves usually present, the lower ones sometimes well-developed, the uppermost bracteate; flowers 1 to several, nodding; sepals ascending to spreading, red-maroon to pink, elliptic to lance-oblong, 8–13 mm long, 4–6 mm wide, acute; petal blades cream-colored, 5–8 mm long, broadly rounded, the spurs red-maroon to pink, 15–22 mm long, 2.5–4 mm wide at base, gradually tapering, the glandular tip bent but not recurved; stamens exceeding the petal blades by 7–12 mm, the anthers 1.2–2 mm long, the staminodia somewhat shorter than the stamens, linear-lanceolate, sometimes bearing abortive (?) anthers; follicles glandular puberulent, 15–20 mm long, the tips spreading, the styles 4–10 mm long.

ADDITIONAL SPECIMENS (PARATYPES; all BRY!): UTAH: Kane Co., ca. 1/4 mi. S of cabins, near head of Wahweap Creek, Four Mile Bench, 16 Jun 1974, *Welsh & Wood 12440a*; near head of Wahweap, T39S R1E S33, 6 Jul 1994, *Welsh & Moore 25323*; ditto, 16 Aug 1995, *Welsh, Atwood & Armstrong 26187*; ditto, 20 Jun 1998, *Atwood & Welsh 23922a*; ditto, 22 May 1999, *Welsh, Atwood & Spencer 27387*; Lick Canyon, tributary of Riggs Canyon, W of No Man's Mesa, 15 Jun 1998, *Welsh & Atwood 27043*; ditto, 1 Oct 1998, *Welsh et al. 27169*; ditto, 18 May 1999, *Atwood, Welsh & Spencer 24480*.

HABITAT AND DISTRIBUTION. *Aquilegia loriae* grows in hanging gardens, moist canyon walls, and sand-seeps in the Straight Cliffs, Moenave, and Navajo Sandstone formations at elevations of 1780 to 1915 m. The species is endemic to Kane County, Utah (Figure 7).

On the Four Mile Bench in eastern Kane County, Utah, both *Aquilegia micrantha* and *A. loriae* grow juxtaposed, but not exactly within the same habitats. Where they grow adjacent to one another at Tommy Water and in the head of Wahweap Canyon, *A. micrantha* occupies drier simple driplines in the Straight Cliffs Formation sandstone, while *A. loriae* occurs in adjacent meadows and as a portion of the ground layer in small clumps of western birch. The distribution of *A. micrantha* is disjunct across that of *A. loriae*, extending west to as far as Water Canyon, west of Kanab, Utah. Intermediates have not been identified where the two taxa grow in close proximity. Most of the known habitat for *A. loriae* is within the newly established Grand Staircase–Escalante National Monument.

This taxon is named in honor of Lori Armstrong, a student of Utah botany who is dedicated to understanding the distribution of Utah's rare plants. It demonstrates considerable variation, as is the rule for practically all taxa within the genus. The main variation in *Aquilegia loriae* involves plant height, degree of viscidity, thickness of leaves, and overall flower size. Some plants from below the cabins in upper Wahweap Canyon show a trend from tall plants with glandular pubescence on lower stems, petioles, and petiolules but not on the leaflets, to much smaller plants that lack glandular pubescence on all lower plant parts. Both of those

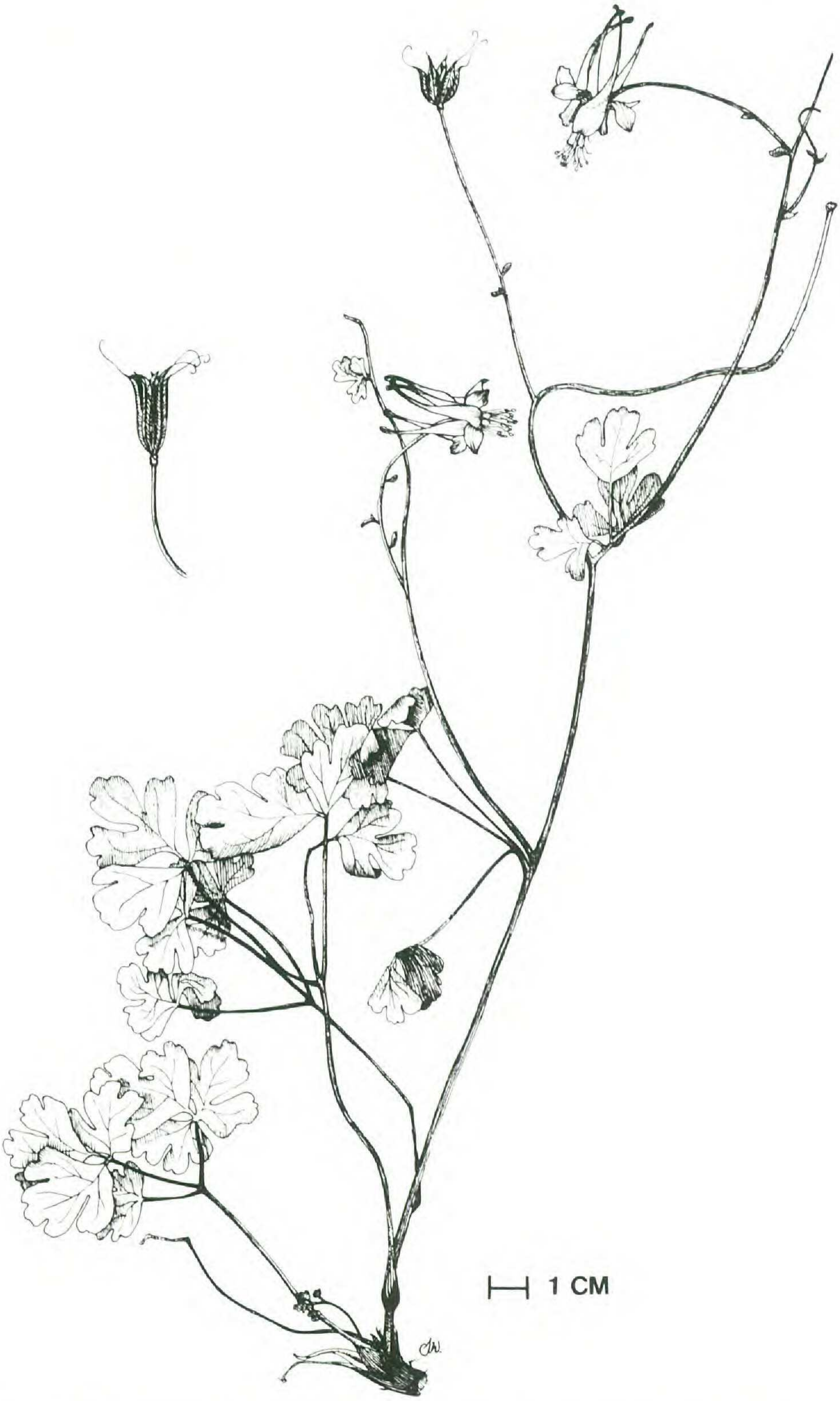

Figure 7. *Aquilegia loriae* S. L. Welsh & N. D. Atwood (*Welsh, Atwood & Armstrong 26178* BRY).

are here considered as a portion of the normal range of variation of the species. First flowers to open, as is the case with practically all members of *Aquilegia,* are frequently the largest, with those produced later in the season being smaller. The flowers within this taxon vary within rather narrow limits.

This entity differs in subtle ways from *Aquilegia desertorum,* but it does so in characteristics that are considered to be of importance in segregation of taxa. Not only is the lower part of the herbage glandular-puberulent in most materials of *A. loriae,* but the petal blades are evidently consistently shorter, 4–5 (not 7–12) mm. There are other minor differences in the flower parts and in their proportions to each other. Furthermore, the taxa are disjunct from each other by more than 200 km.

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